

Appl. No. 10/817,379
Amdt. dated Dec. 20, 2005
Reply to Office Action of Oct. 3, 2005

AMENDMENTS TO THE SPECIFICATION:

Please replace the paragraph beginning at page 4, line 16 with the following rewritten paragraph:

In the out-of-position case, occupant sensors are now being considered to prevent or control the deployment of the airbag to minimize deployment induced injuries. These occupant sensors will significantly reduce the number of deaths caused by airbags but in doing so, they ~~[[car]]~~ can deprive the occupant of the protection afforded by a softer airbag if the deployment is suppressed. Side and side curtain airbags are being installed to give additional protection to occupants in side impacts and rollovers. However, there still will be many situations where occupants will continue to be injured in crashes where airbags could have been a significant aid. What is needed is an airbag system that totally surrounds the occupant and holds him or her in the position that he or she is prior to the crash. The airbag system needs to deploy very rapidly, contact the occupant without causing injury and prevent ~~[[her]]~~ his or her motion until the crash is over. This is a system that fills up the passenger compartment in substantially the same way that packaging material is used to prevent breakage of a crystal glass during shipment.

Please replace the paragraph beginning at page 5, line 13 with the following rewritten paragraph:

The main argument against anticipatory sensors is that the mass of the impacting object remains unknown until the accident commences. However, through using a camera, or other imaging technology based on, for example, radar or terahertz generators and receivers, to monitor potentially impacting objects and pattern recognition technologies such as neural networks, the object can be identified and in the case of another vehicle, the mass of the vehicle when it is in the unloaded condition can be found from a stored table in the vehicle system. If the vehicle is a commercial truck, then whether it is loaded or not will have little effect on the severity of an accident. Also if the relative velocity of the impacting vehicles is above some threshold, then again the mass of the impacting vehicle is not important to the deployment decision. Pickup trucks and vans are thus the main concern because as loaded, they can perhaps weigh 50 ~~or more~~ percent or more than when unloaded. However, such vehicles are usually within 10% of their unloaded-plus-one-passenger weight almost all of the time. Since the decision to be made is whether or not to deploy the airbag, in all severe cases and most marginal cases, the correct decision will be made to deploy the airbag regardless if there is additional weight in the vehicle. If the assumption is made that such vehicles are loaded with no more than 10% additional weight, then only in a few marginal crashes, a no deployment decision will be made when a deployment decision would be correct. However, as soon as the accident commences, the traditional crash sensors will detect the

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accident and deploy the airbags, but for those marginal cases the occupants will have obtained little relative forward velocity anyway and probably not be hurt and certainly not killed by the deploying plastic film airbags which stop deploying as soon as the occupant is contacted. Thus, the combination of anticipatory sensor technology and plastic film airbags as disclosed herein results in the next generation self adapting safety system that maximizes occupant protection, both technologies preferably but not required to be those implemented or developed by the current assignee.

Please replace the paragraph beginning at page 22, line 23 with the following rewritten paragraph:

Another important difference between this invention and prior art is that the present invention can be installed without any reactive surface behind the invention. Most prior art restraint devices of this type require the dashboard to extend low enough to provide a reactive surface for either the knees or a conventional ~~air-bag~~ airbag. This invention does not require this additional surface area protruding from the dashboard since it is supported by the filling of the entire volume with airbags which are effective to transfer the reaction to whatever vehicle structure is available, such as the firewall. This invention therefore allows more leg room for the occupant in its non-inflated condition, increasing occupant comfort and reducing the possibility that the occupant will be trapped beneath the dashboard during a crash. Since prior art restraint devices require strong reactive surfaces, the total system (module and support structure) can be heavy and/or bulky. The present invention does not include nor require a heavy support structure since it employs the already existing vehicle side structure and/or tunnel.

Please replace the paragraph beginning at page 32, line 2 with the following rewritten paragraph:

In FIG. 1, the driver airbag is shown in the inflated condition generally at 320 with one film layer 321 lying inside a second film layer 322. The film layers 321, 322, or sheets of film laminated or otherwise attached together, are non-perforated and are also referred to as airbags or layers herein since they constitute the same. FIG. 1A is an enlarged view of the material of the inner layer 321 and outer layer 322 taken within circle 1A of FIG. 1. When manufactured, the film of the inner layer 321 may ~~[[321]]~~ be made from a thermoplastic elastomer such as polyurethane, for example, as shown in FIG 1A, and the outer layer 322 may be made from a more rigid material such as NYLON® or polyester. The two film layers 321, 322 are held together along their adjacent regions by adhesive such as an adhesive 323 applied in a manner sufficient to provide adherence of the two film layers 321, 322 together.

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Please replace the paragraph beginning at page 38, line 3 with the following rewritten paragraph:

Typically, inflatable knee bolster installations comprise an inflatable ~~air-bag~~ airbag sandwiched between a rigid or semi rigid load distributing impact surface and a reaction surface. When the inflator is triggered, the ~~air-bag~~ airbag expands to move the impact surface a predetermined distance to active position. This position may be determined by tethers between the reaction and impact surfaces. These installations comprise numerous parts, bits and pieces and require careful installation. In contrast, in a preferred knee bolster described herein, there is no rigid load distributing surface but rather, the knee bolster conforms to the shape of the knees of the occupant. Tethers in general are not required or used as the shaping properties of inelastic films are utilized to achieve the desired airbag shape. Finally, the preferred designs herein are not composed of numerous parts and in general do not require careful installation. One significant problem with the use of load distribution plates as is commonly done in the art is that no provision is made to capture the knees and thus, especially if the crash is an angular impact or if the occupant is sitting on an angle with respect to the knee bolster or has his or her legs crossed, there is a tendency for the knees to slip sideways off of the knee bolster defeating the purpose of the system. In the multi-cellular knee bolster disclosed herein, the cells expand until they envelop the occupant's knees, capturing them and preventing them from moving sideways. Once each cell is filled to a design pressure, a one-way valve closes and flow out of the cell is prevented for the duration of the crash. This design is especially effective when used with an anticipatory sensor as the knees can be captured prior to movement relative to the passenger compartment caused by the crash. A signal from the anticipatory sensor would initiate an inflator to inflate the knee bolster prior to or simultaneous with the crash.

Please replace the paragraph beginning at page 44, line 32 with the following rewritten paragraph:

One scenario is to use a camera, or radar-based or terahertz-based anticipatory sensor to estimate velocity and profile of impacting object. From the profile or image, an identification of the class of impacting object can be made and a determination made of where the object will likely strike the vehicle. Knowing the stiffness of the engagement part of the vehicle allows a calculation of the mass of the impacting object based on an assumption of the stiffness impacting object. Since the impacting velocity is known and the acceleration of the vehicle can be determined, we know the impacting mass and therefore we know the severity or ultimate velocity change of the accident. From this, the average chest acceleration that can be used to just bring the occupant to the velocity of the passenger compartment

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during the crash can be calculated and therefore the parameters of the airbag system can be set to provide that optimum chest acceleration. By putting an accelerometer on the airbag surface that contacts the occupant, the actual chest acceleration can be measured and the vent size can be adjusted to maintain the calculated optimum value. With this system, neither crush zone or occupant sensors are required, thus simplifying and reducing the cost of the system and providing optimum results even without initiating the airbag prior to the start of the crash.

Please replace the paragraph beginning at page 46, line 3 with the following rewritten paragraph:

FIG. 16A ~~illustrated~~ illustrates a view from the top of the vehicle with the roof removed taken along lined 16A-16A in FIG. 16 with the vehicle unoccupied. As can be seen, primary airbag 440, for example, is actually a row of tubular structures similar to that shown in FIG. 7. Additionally, curtain airbags 466 are present only in this implementation and they also comprise several rows of tubes designed to contact the occupants and hold them away from contacting the sides of the vehicle. Airbags 467 are also advantageously provided down the center of the vehicle to further restrain the occupants and prevent adjacent occupants from impacting each other.

Please replace the paragraph beginning at page 52, line 26 with the following rewritten paragraph:

The barrier coating mixtures used in the invention are selected by balancing several critical features, i.e., appropriate dispersion of the filler in the elastomeric polymer, orientation of the filler platelets in the elastomeric polymer, as well as high aspect ratio of the filler, in order to achieve the desired permeability reductions and flexibility in the dried barrier coating and in the airbags. These characteristics are demonstrated by the data shown in FIG. [[1]] 26. The barrier coating mixture of this invention desirably contains an unusually low solids content, i.e., between about 1% and about 30% solids. A more desirable range of solids content is between about 5% to about 17% solids.

Please replace the paragraph beginning at page 53, line 3 with the following rewritten paragraph:

The relationship between the percentage of solids in the coating composition to the weight percent of filler in the resulting dried coating is an unexpectedly important issue in obtaining desired barrier coatings of this invention. For example, in embodiments in which the barrier coating composition contains as the elastomeric polymer, butyl rubber (Lord Corporation), and as the filler, MICROLITE® 963++ vermiculite solution (W.R. Grace & Co.), FIG. [[4]] 29 illustrates a range of maximum total solids

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that can be used in the coatings formulation of this invention without resulting in agglomeration and other negative effects on the dried coating (i.e., film) properties as a function of the fraction of the total solids made up by the filler.

Please replace the paragraph beginning at page 53, line 10 with the following rewritten paragraph:

In one embodiment, where the MICROLITE® filler is at 5%, the maximum solids is about 16%; in another wherein the filler is 25%, the maximum solids is about 9%. In still another embodiment, where the filler is about 50%, the maximum solids is about 5%. Other examples fall within those ranges, as indicated in FIG. [[4]] 29. The results shown in FIG. [[4]] 29 are based on the formulations used in Examples 9-12.

Please replace the paragraph beginning at page 53, line 14 with the following rewritten paragraph:

The unusually low solids contents described in FIG. [[4]] 29 for a butyl-containing polymer latex are also applicable to other elastomeric polymer latexes, as well as to elastomeric polymers in carrier liquids which also contain other solvents or co-solvents. One of skill in the art will understand the need to make some alterations in the maximums provided by FIG. [[4]] 29 for other formulations of barrier coatings of this invention taking into account changes in electrolyte concentration, surfactants, grade and composition of vermiculite or other filler, and grade and composition of polymeric latex or other elastomeric polymer in a carrier as described herein.

Please replace the paragraph beginning at page 53, line 20 with the following rewritten paragraph:

If desired, the solids content of the barrier coating mixtures can be further adjusted to levels below the maximums shown in FIG. [[4]] 29 using thickeners, in order to adjust the final film thickness, as well as to adjust the suspension rheology. See, for example, Examples 14-15 which demonstrate the increase in viscosity from 4.5 cP to 370 cP using PVOH terpolymer; and Example 16 which similarly increases viscosity using lithium chloride as a thickener. Other conventionally used thickeners may also be useful.

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Please replace the paragraph beginning at page 54, line 36 with the following rewritten paragraph:

The coating mixtures of this invention as described above also include a dispersed layered filler which, upon mixture, has an inherently high aspect ratio, which can range from about 25 to as high as about 30,000. The presently preferred filler is vermiculite. More particularly, a desirable vermiculite is MICROLITE® 963++ water-based vermiculite dispersion (W. R. Grace) [see, EP Application No. 601,877, published June 15, 1994] which is a 7.5% by weight aqueous solution of dispersed mica. One novel aspect of the mixtures of the present invention is the effective aspect ratio of the selected filler in the dried coating. According to this invention, in the dried coating, the filler remains substantially dispersed, thereby having a "high effective aspect ratio", as shown in FIG. [[1]] 26. FIG. [[1]] 26 assumes high levels of orientation.

Please replace the paragraph beginning at page 55, line 7 with the following rewritten paragraph:

Preferably, the effective aspect ratio of the filler in the compositions of this invention is greater than 25 and preferably greater than about 100, although higher ratios may also be obtained. In embodiments in which orientation is not high, the effective aspect ratio required for large reductions in permeability will be higher than 100. In the coating mixtures (the liquid), the layered filler is present at between about 1 to about 10% by weight of the total mixture. In the dried coatings of this invention, the layered filler is present at a minimum of about 5% by weight to a maximum of about 55% of the dried coating. The compositions of the present invention, when dried, retain the filler in well-dispersed form, resulting in a high effective aspect ratio of the dried coating, and greatly increased reduction in permeability, as illustrated in FIG. [[1]] 26.